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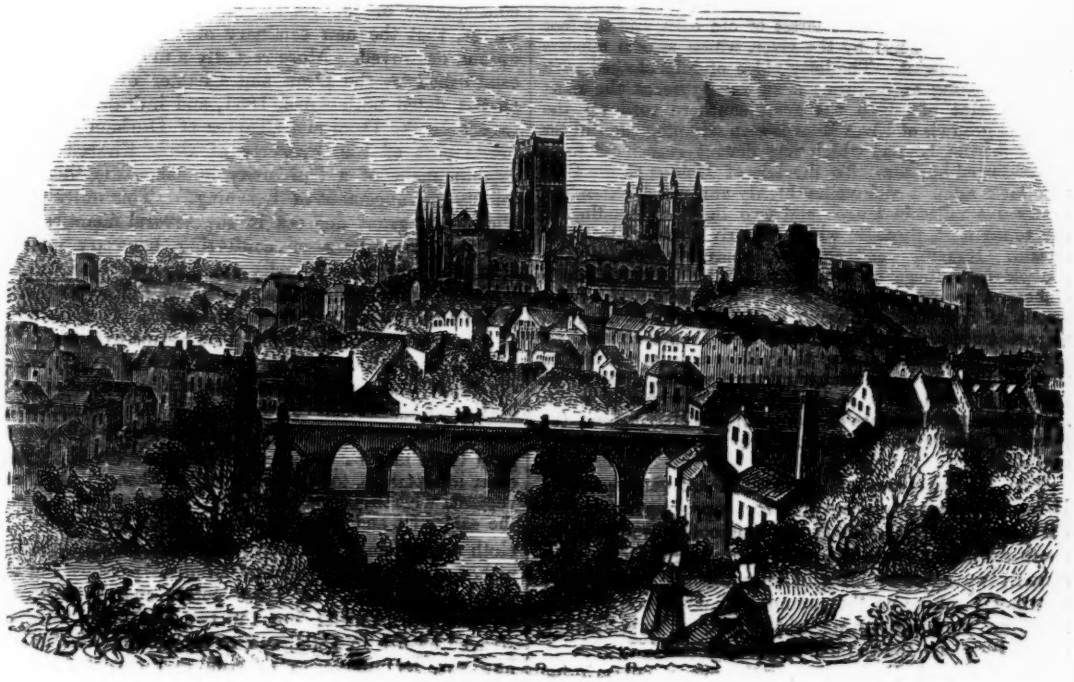
THE CITY OF DURHAM.



GENERAL VIEW OF DURHAM

II.

Some notices of the early history of Durham have been recently given in this work; and it may now be desirable to describe the general appearance of this ancient and picturesque city, and also to note the more remarkable edifices and institutions contained within it, or nearly adjoining to it.

Durham Castle, the residence of the Bishop when he visits the city, stands on a continuation of the same rocky eminence on which the Cathedral is built, and from its upper apartments commands some very fine views of the city and surrounding country. The most ancient part is the keep, supposed to be of Norman construction. It appears originally to have contained four stories or tiers of apartments, besides a series of vaults. A parapet, defended by an embattled breast-work, once surrounded the summit; but having become ruinous, it was taken down in 1789. The buildings which complete the present castle have been erected at different times, and are not uniform. The hall is one hundred and eighty feet long, fifty feet broad, and thirty-six feet high. A most beautiful archway in the gallery of this castle, supposed to have been stopped up for centuries, was opened by Bishop Barrington, and is considered one of the most perfect specimens of Anglo-Norman architecture extant. Before the erection of the county courts, gaol, &c., the north gateway of this castle was made use of as a prison. The buildings of the castle occupy the north side of an open space or area, called Place or Palace Green. From this green there is an avenue leading to some public walks, called the Banks, which skirt the river, and command some interesting views of the city, the castle, and cathedral. Warner thus describes these celebrated walks in his *Northern Tour*: "The banks, rocky and abrupt, on one hand, and sloping gently to the river on the other, darkened by a solemn depth of shade, sequestered and retired, in the immediate neighbourhood of a busy scene of society, afford a retreat of the most beautiful and agreeable nature. The variety of the scenes which they open also is remarkable; deep glades and solemn dells, scarred rock and verdant lawn, sylvan glades, and proud castellated edifices. From the elegant bridge the last-mentioned feature is seen to great effect; the castle and cathedral blend their battlements and turrets together, and rise with inconceivable majesty from the sacred groves which clothe their rocky foundations. The combination here of trees and buildings, water and rock, home sylvan scenery and fine distance, is at once beautiful and grand."

The bridge here spoken of was built in 1777, at the expense of the Dean and Chapter. The former bridge, which was only of sufficient width for foot passengers and horses, was carried away by a dreadful flood a few years previously. Besides this, which is called the New Bridge, there are two others in Durham., *i. e.*, Framwell Gate Bridge, and Elvet Bridge.

Besides the cathedral, Durham contains six churches; St. Nicholas, an ancient structure on the south side of the market-place; St. Mary le Bow, or Bough, built, according to tradition, on the spot where St. Cuthbert's remains were deposited, in a tabernacle of boughs, when first brought to Durham by the monks; St. Oswald's; St. Giles's; St. Margaret; and Little St. Mary. St. Giles stands upon elevated ground, and the church-yard

commands a most extensive and beautiful view. Meadow-grounds and wooded enclosures slope towards the river, which forms a beautiful canal of nearly a mile in length, having on the opposite bank the gradual ascent called the Race Ground, and the beautiful suburbs and gardens of the city. The noble cathedral, the octagonal tower of the castle, the gloomy buildings of the gaol, and indeed all the most striking features of the city, are to be seen from this point. The more distant features of this romantic landscape have been thus described. "Over the meadows in the centre a precipice rises nearly one hundred perpendicular feet in height, called Maiden Castle Scar or Cliff; the steep sides of the hill to the right and left are covered with a forest of old oaks, and the foot of the cliff is washed by the river, whose stream appears again at this point. The lofty ridge of hills clothed with oaks, stretching away, forms a zig-zag figure, at the most distant point of which the great southern road up the enclosed grounds of Elvet Moor is seen climbing the hill for nearly a mile, beyond which very distant eminences form a blue-tinged horizon. To the left of Maiden Castle Cliff you look upon a rich valley highly cultivated, extending nearly five miles in length and two in width, bending to the south-west, through which the river winds its silver stream. Hanging woods shut in the nearer vale, where lies the pleasant village of Shincliff, with its bridge of three arches. The extreme part of the valley is closed by the woods of Shincliff, Butterby, and Croxdale, forming an elegant amphitheatre; over these rise distant hills, lined out with enclosures, giving the yellow and brown tint to the landscape over the richer coloured woods. The whole finished with an elevated horizon, on the wings of which are scattered the villages of Terryhill and Merrington; the tower of Merrington Church forming a beautiful and lofty obelisk."

The Market-Place of Durham is not very spacious. It has in the centre a conduit for supplying water; on the west side a Guildhall or Tolbooth; and on the south a Piazza, where the corn markets are held. The conduit is a stone building of an octagonal form, with a figure of Neptune on the summit. The water is brought from an enclosed spring about half a mile distant, originally given for the use of the city in 1451.

There are at Durham an infirmary, a subscription library, a theatre, &c. The race-course of this city appears to have been established as early as the reign of Charles the Second. It was not until the reign of that monarch that either the county or city of Durham had been represented in parliament, for the power of the Bishops had been so great that the return of members was up to that time wholly unnecessary. But what had been previously avoided as a burthen, was then demanded as a right, and in 1673 this privilege was awarded to Durham.

Our notices of the early history of Durham give an account of the frequent pillagings and devastations to which the city and its suburbs were subject. In the reign of Edward the Second the neighbourhood of the city was again pillaged, and the houses reduced to ashes, by a part of Bruce's army.

But a more pleasing picture subsequently opens. In 1333, a grand entertainment was given by Richard de Burg, on his promotion to the bishopric of Durham, and among his guests were Edward the Third, his Queen, the Queen Dowager, the King of Scotland, the two metropolitans, five bishops, seven earls and their ladies, all the nobility north of the Trent, with a vast concourse of knights, abbots, priors, &c. A similar festive entertainment was held at Durham in the reign of Henry the Sixth, on the marriage of James, king of Scotland, with Jane of Somerset, grand-daughter of John of Gaunt.

Durham was visited with the plague in 1416, 1589, and 1597, and on the last occasion it raged with so much violence that the poorer people were compelled to live in huts on Elvet Moor and the adjoining commons.

In the time of the Commonwealth, the parliament having passed an act for abolishing deans, canons, prebends, &c., and taking all their honours, manors, and lands, it was agreed that a college should be founded and endowed at Durham, out of the wealth thus obtained. The new university was scarcely settled when Oliver Cromwell died. Nevertheless the institution appeared to thrive so well that it excited the jealousy of Oxford and Cambridge, from whence petitions were presented against it to the new protector, and some persons were sent from both places to give reasons against a *third* university, and especially against conferring any degrees there. But shortly after this protest, Richard Cromwell being deprived of the protectorate, the existing government was once more overturned, and it followed as a consequence of the restitution of the former state of things, that the new seminary of learning was broken up and destroyed. More recently a university has been established by the Dean and Chapter of Durham, by an act dated 28th April, 1831, and intituled "An Act to enable the Dean and Chapter of Durham to appropriate part of the Property of their Church to the establishment of a University in connexion therewith, for the advancement of Learning." This university is allowed to grant degrees in the several faculties; and has also the power of conferring honorary degrees. The affairs of the university are managed by a warden, a senate, and a convocation, with the Bishop as visitor, and the Dean and Chapter as governors.

The trade of Durham is by no means extensive. In 1598 a bequest was made to the city by a Mr. Henry Smith, of all his coal-mines, then of the annual value of 100*l.*, and a personal estate worth 600*l.* The intention of this bequest was, according to the will, "that some good trade may be devised for setting of the youth, and other idle persons, to work, as shall be thought most convenient, whereby some profit may arise to the benefit of the said city, and relief of those who are past work." A cloth manufactory was therefore established, which furnished employment to several hundred persons, but this has totally failed. A large cotton manufactory was likewise established; but the two buildings were destroyed by fire in 1804, and never rebuilt. There are, however, manufactories of stuff and carpets, and for spinning and combing wool, a hat manufactory, two iron-foundries, and a brass-foundry. The fairs for cattle and horses are celebrated. Various charitable bequests have been made to the poor of the city.

At the distance of about two miles from Durham is a hospital, founded by Bishop Pudsey in 1180, for sixty-five poor lepers; a master, and other officers. The ancient buildings, though partly destroyed by the Scots, have been repaired and restored at different periods, and the body of the chapel as it still exists is supposed to be as ancient as the foundation. It is lighted by three narrow windows, under circular arches, and ornamented with small round pilasters, belted and capitalled like those in the east part of the cathedral. This hospital was originally intended to receive both male and female lepers, each sex having their respective houses, and the men being permitted to elect a prior, the women a prioress. "Each leper was to have a loaf and a gallon of beer daily; three days in the week flesh meat, and four days, fish; so that one dish of meat, fish, cheese, or butter should serve two; but on great days two were to be provided, particularly on Quadragesima-day, when they were allowed fresh salmon, or other fish, if they could be had, for one dish; and on Michaelmas-day they were to have geese, a goose for every four. They were allowed yearly three yards of woollen cloth, russet or white, six yards of linen, and six yards of canvas, with other necessaries, as trusses of straw and bundles of reeds, with four yule logs for the vigils of our Saviour."

In 1434, the leprosy being nearly eradicated in this country, a change was made in the institution, and two lepers only, "if they could be found," were directed to be admitted upon the establishment. To these were added thirteen poor people, "to be provided with meat and drink of ten-pence value every week, or ten-pence in

ready money, at their own option; and have yearly the sum of six shillings and eight-pence for fuel and clothes."

In 1584 an act passed for incorporating the brethren and their successors as the Master and Brethren of Christ's Hospital, in Sherborne, near Durham. The in-brethren are now fifteen in number, and are each accommodated with a neat room, sufficient wholesome diet, a suit of clothes annually, and forty shillings in money; the out-brethren, who are also fifteen, are allowed a similar sum. The present master is the Bishop of Rochester.

About a mile from the city stand the remains of the Hospital of St. Giles. Of the monastic buildings once existing here, only a massive gateway, with pointed arch and groined roof, exists. The hospital was founded by Ralph Flambard, bishop of Durham, in 1112. The church as well as the hospital were sacked and destroyed in less than thirty years after this period, by William Comyn, the Scottish intruder on this see. The second founder, Prelate Hugh, in his charter ordains that the hospital shall consist of a master and thirteen brethren, six of whom shall be chaplains, to pray for the soul of Bishop Hugh and Bishop Ralph (the first founder). The seventh brother was to be steward; the eighth, keeper of the tan-yard; the ninth, baker; the tenth, miller; the eleventh, granger; the twelfth, keeper of the stock; and the thirteenth, receiver and attorney-general, for transacting all matters of the house at home and abroad. The sick brethren were to be removed to the infirmary. The chaplains were to have new boots twice in the year. The house was to be free of toll; the brethren were to have pasture for their cattle, wood for fuel and building, and pannage of mast and acorn for their hogs, from Bishop Hugh's forest. He also gave them a lead-mine, to cover their church of St. Mary and All-Saints, and their infirmary; an iron-mine in Rookhope, to supply the iron-work of their carts and wains. They also had leave "that their dogs there and at their vaccary in Weardale shall not have their fore-feet amputated*; but only the shepherds shall lead them in leashes, to guard their cattle from the wolves."

The charters (says Mr. Surtees) carry us back to the habits and feelings of a remote age, when few of the necessaries or luxuries of life were acquired by the easy means of an established metallic currency, but each household and each establishment depended for very existence on its own peculiar resources; when the different departments of art and labour were not distributed as now for the mutual convenience of all, but each isolated establishment contained its own artisans of every necessary order.

By a grant of Robert Corbet, the house became possessed of a large district on the wild borders of the Darwent. There they reared herds of cattle and fed droves of swine, whilst at home they had their store-house for grain, their larders for salted provisions, and their tan-yard for the hides. Their lead and their iron they brought from Weardale.

Lands and livings from successive benefactors were continually swelling the revenues of the hospital; but they suffered severely during the period when Robert Bruce avenged the injuries of Scotland by repeated successful invasions of the bishopric. The hospital of St. Giles was burned in 1306, and amongst other losses the evidence room was consumed in the flames, with all the charters of the house. Bishop Kellow, as the only means of remedying the evil, issued a commission to inquire what lands the hospital held, and by what rents and services, on the day of the fire. A goodly list of charters was proved before the jurors, and the whole record of the same was exemplified on the chancery rolls of Bishop Nevill.

After the surrender, Henry VIII. granted the hospital, with its immense possessions, to Sir William Paget and Richard Cock.

* It was a barbarous provision of the Norman Forest Laws, that every dog kept in chase or forest should have the fore-feet maimed, to prevent his chasing the game.

The vegetable kingdom expands everywhere before us an immense portraiture of the Divine mind, in its contriving skill, profuse imagination, conceiving genius, and exquisite taste; as well as its interesting qualities of the most gracious benignity and the most benevolent munificence. The various flowers we behold, awaken these sentiments within us, and compel our reason to make these perceptions and this inference. They are the annual heralds and ever-returning pledges to us of His continuing beneficence, or His desire to please and to benefit us, and, therefore, of His parental and intellectual amiabilities. They come to us, together with the attendant seasons, that nurse and evolve them, as the appointed assurances that the world we inhabit is yet to be preserved, and the present course of things to go on. The thunder, the pestilence, and the tempest, awe and humble us into dismaying recollections of His tremendous omnipotence and possible visitations, and of our total inability to resist or avert them; but the beauty and benefactions of His vegetable creations, the flowers and the fruits more especially, remind and assure us of His unforgetting care, of His condescending sympathy, of His paternal attentions, and of the same affectionate benignity still actuating His mind, which must have influenced it to design and execute such lovely and beneficent productions, that display the minutest thought, most elaborate compositions, and so much personal kindness.—Sharon Turner's *Sacred History of the World.*

In a single hour you may discover whether a man has good sense; but it will require many years to discover whether he has good temper.

Clemency to the wicked is often an injury to the good.

If learning were banished from the earth, there would, notwithstanding, be few men who would think themselves ignorant.

Instruction is only profitable to those who are capable of receiving it. Bring an ass to Mecca, and it will still return an ass.

It is not impossible that national reformation will begin with national distress.—Rees' *Cyclopædia.*

An excuse is worse and more terrible than a lie; for an excuse *is a lie guarded.*—Swift.

Two kinds of men labour in vain: they who get riches, and do not enjoy them, or apply them; and they who learn wisdom, and do not practise it.

An opinion received or maintained without proper regard to the arguments which may prove it true, is a *prejudice;* whether the opinion be true or false. In most cases prejudices are opinions which, on some account, men are pleased with, independently of any conviction of their truth; and which, therefore, they are afraid to examine, lest they should find them to be false. Prejudices, then, are unreasonable judgments, formed or held under the influence of some other motive than the love of truth.—*Elements of Thought.*

History, instead of supplying us only with the knowledge of facts, may give us a farther insight into the human heart, and furnish many useful observations in regard to our conduct in life, if we accustom ourselves to seek the remote causes of great events, and trace to their source the secret springs of action, which will often be found far different from what, at first sight, they appear to have been.

Man is an animal, formidable both from his passions and his reason; his passions often urging him to great evils, and his reason furnishing means to achieve them. To train this animal, and make him amenable to order, to inure him to a sense of justice and virtue, to withhold him from ill courses by fear, and to encourage him in his duty by hopes; in short, to fashion and model him for society, hath been the aim of civil and religious institutions, and, in all times, the endeavour of good and wise men. The aptest method for attaining this end hath been always judged a proper education.—Bishop Berkeley.

THE ATMOSPHERIC RAILWAY.

I.

Propelled through magic tubes by "liquid air,
(That viewless power, existing everywhere,
Balanced—unfelt! The equilibrium break;
And wild tornadoes earth's foundations shake:
Or dying land-winds tell the approach of morn:
Or fitful breezes fan the waving corn:
Or oaks and cedars, from the earth uptorn,
Lie prostrate.)
. . . . . : Thus impelled,
The piston rushes in its rapid course—
The *unbalanced* ether, the impelling force.

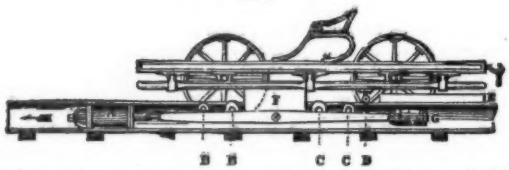


Fig. 1. Longitudinal section of the Vacuum Pipe, and side view of the Driving Carriage attached to the Piston.

YES, it was the rush of the experimental train on the Dalkey Atmospheric Railway, in its up-hill flight! for we must acknowledge that sixty miles an hour, inclusive of the time allowed for the pipe, and the passengers, to recover their breath, is at least a little like flying; more especially when, as in this case, there is no apparent mechanical motive power. But we can assure the reader that if his ideas of railway travelling have been confined to twenty or thirty miles an hour, with a groaning, hissing, locomotive, it is now time for him to look out for the schoolmaster, abroad or at home, and to take some lessons in aërial philosophy. He has perhaps seen a rope of wire—may have been attached to a rope of hemp—has heard at least of a rope of sand—but if he will pass over to the green Sister Isle of the ocean, he shall be drawn from Kingstown to Dalkey by a rope of air. 'Tis a veritable fact, and no Irish bull; and we hope events will soon prove that it is no Irish blunder.

Some of our readers may recollect the ingenious project, devised some eighteen or twenty years ago, for connecting the great metropolis with that summer resort of fashionable metropolitans, Brighton, by means of an air-tight pipe or tunnel, sufficiently capacious to admit passenger-carriages. This tunnel being made smooth internally, and the first vehicle fitting tolerably close; supposing the pipe was partially exhausted of air, in front of the train of carriages; supposing, secondly, that the tunnel was of sufficient strength to withstand the external pressure of the atmosphere; and supposing, thirdly, that the public were willing to patronize so novel a mode of transit, why then it was quite clear, (to the mind of the projector,) that his imprisoned Londoners might very easily slide along through this capacious tube or tunnel, and would soon be liberated on the shores of Brighton.

To evince the feasibility of such a scheme, by experiments on a lilliputian scale, was a task of very easy accomplishment. In this case, however, as in thousands of others, the public were not able to reciprocate the views entertained by the projector, of its practical utility, or its unnumbered advantages.

But the idea of making use of the pressure of the atmosphere as a motive power for the transit of passengers on railways has never been abandoned. To the sister Island belongs the merit of having reduced it to practice; and though our Irish neighbours are not to be whirled *through* an air-tight tunnel, yet the impelling power on the Dalkey Railway is the same as that alluded to above, namely, the rushing of the air into a partially exhausted pipe: and however improbable Vallance's Brighton tunnel may now appear, we must yet concede to it the merit of ingenuity: it was a step towards the accomplishment of that which has assumed a practicable shape under the hands of Clegg and Samuda.

It is well understood that near the earth's surface the atmosphere exerts a pressure equal to about fourteen or fifteen pounds on the square inch, varying of course with the varied weight indicated by the mercurial column of the barometer; and that the pressure is equally exerted in all directions. It is this force that raises the water in a common pump, and supports the mercury in the tube of a barometer. And the schoolboy who places his moistened leather sucker upon a stone, is but calling into exercise the same power, that power which propelled the liquid aliment from its source, when, entering upon the stage of life, and untaught save by an innate philosophy, he first applied his little vacuum engine to his mother's breast.

When, in the now so oft repeated pneumatic experiment, we place the hand on the exhausted receiver of an air-pump, it is this same pressure which prevents our removing it; and were we, for the ordinary glass receiver, to substitute an iron pipe with a moveable piston, we should find that the piston would be forcibly drawn or propelled into the pipe. Now as the air presses equally in all directions, upwards, downwards, and laterally, the piston would pass along the pipe, whether it were a vertical or a horizontal one.

The unscientific reader will by this time perceive that if an air-tight pipe of sufficient capacity were laid down on a road (say a mile in length), and at one end of this pipe was a large air-pump capable of rapidly withdrawing the air, and at the opposite end was a piston working in the pipe, with a rope a mile in length attached to the piston at one extremity, and at the other to a train of carriages, which would of course be a mile from the pipe; if the air was then pumped out of the pipe, the atmospheric pressure upon the piston would drive it along the tube, and the carriages would be drawn after it. But in practice this plan would not be available.

It still remained for some one to overcome the difficulty, and to discover a plan by which the piston and the carriages might be made to travel in company, as the small tube or socket inside a common pencil-case, into which we fasten the cedar pencil, moves with the fingers that slide the pencil backwards and forwards along the case.

With this object it was proposed to employ pipes with lateral openings, by means of which a connecting-rod might be attached to the piston and the carriages: and it was thought that, with a rope for a cover to this opening, a sufficient rarefaction of the air in the tube could be obtained for practical purposes. This also was a failure; and it was reserved for the present patentees, Messrs. Clegg and Samuda, to bring into practical operation as a railway motive power, that atmospheric pressure, with the existence and the force of which we had so long been familiar.

We believe the experiment was first tried, some three or four years ago, on a portion of the West London Railway at Wormwood Scrubbs. A series of cast-iron pipes, nine inches in diameter, and extending half a mile in length, was laid down; and though neither the pipe nor the rails were in good order, yet on a gradient of about 1 in 115, and with an exhaustion that indicated a pressure on the piston of about nine pounds to the square inch, a load of goods weighing several tons was propelled at more than twenty miles an hour; and a speed was attained, during some of the experiments, of thirty to forty miles, with a steam-engine to work the pump that was quite inadequate to the work.

These experiments were decidedly encouraging; and eventually the Government agreed to advance a loan to the Dublin and Kingstown Railway Company, for enabling them to construct a line on the pneumatic principle from Kingstown to Dalkey, a distance of about a mile and three-quarters. The various opposing diffi-

culties have been overcome; and the line was ready for the transit of passengers at the end of last year.

Referring again to our illustration of the pencil-case, the small socket may be called the piston, and the finger may be considered as the drawing carriage—with this difference, that the fingers in the one case move the socket; in the other case the power is reversed, and the piston (or socket) moves the carriage (or fingers).

The vacuum pipe, which is the distinguishing characteristic of this railway, is about fifteen inches internal diameter: it is of cast-iron, united in the same manner as the gas or water pipes in our streets, and is laid in the centre between the two rails. A simple cutter is passed through the pipes when they come out of the foundry sand; and being raised to the temperature of melting tallow, a mop dipped in this material is passed through them, and being followed by a wooden piston, the inside becomes coated with a thin surface of tallow, which soon acquires considerable hardness; so that practically the travelling piston moves in a tube of tallow, and this method is found very effectual in preventing atmospheric leakage. On the top of the tube is a narrow opening, extending the whole length, which is closed with a valve for the purpose of rendering the tube air-tight when required. This valve is a continuous flap of leather, on the upper and under sides of which are riveted plates of iron, the inner surface of the lower plate being so shaped as to form, when the valve is closed, a portion of the circumference of the pipe; the upper plate and the leather being both a little wider than the opening or "slot," and made to extend over it on each side. This continuous valve is hinged on one side to a projecting rib; and the other edge falls into a groove containing a mixture of wax and tallow, which, when melted, seals up the pipe, and makes it sufficiently air-tight for practical working. There is also a contrivance, called the weather-valve, for protecting the apparatus from the weather.

A reference to fig. 2, which is a cross section of the pipe when closed, will assist the reader in comprehending its structure.

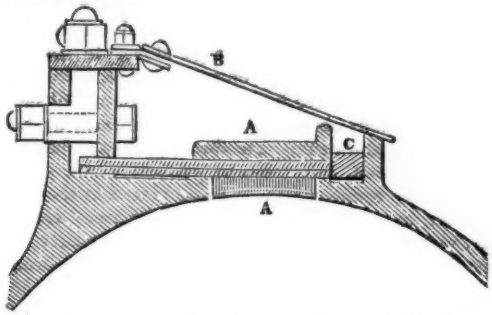


Fig. 2. Transverse section of the upper part of the Vacuum Pipe when the valves are closed.

A A is the air-tight valve;
B the weather valve; and
C the composition of wax and tallow, or other suitable ingredients.

In a second article on this magic tube, we propose to give one other illustrative engraving. With the help of this, and of the longitudinal section at the head of this article, a description of which is purposely deferred, we hope to make the working of the apparatus quite intelligible to the general reader.

The *way* of every man is prophetic of the *end* of that man.

It is a mortification to human wisdom, that every new discovery only serves to prove our ignorance, by opening new mysteries which elude our enquiry, and that though the means of investigation are improved daily by scientific skill and industry, there still remain innumerable secrets, which no experiment can analyse, nor any theory explain. —Baseley.

ON HOSPITALS.

IV.

Among the subjects which arrest our attention in considering the Continental Hospitals are those of them in which patients are admitted by paying a sum of money. There are several institutions of this kind at Paris; and it is said that great benefit has resulted from them to the classes of the community for which they were instituted. Of these, St. Perine, containing 175 beds, instituted in 1801, is the most important. Persons of either sex, who have reached the age of sixty, are admitted at the annual sum of twenty-four pounds. It is an excellent resource for small proprietors, employés, and others of limited means, who do not wish to become a burden to their friends. They may commence paying the subscription by advance at the age of forty, or may purchase the annuity for a fixed sum. The Hospice de Rochefoucauld is for a lower degree of persons, where they pay from eight to ten pounds. The Hospice des Menages admits 682 persons. The best chambers are reserved for married couples, at a hundred and twenty pounds per annum. Eighty beds are reserved for the destitute who can prove they have lived man and wife for twenty years. One hundred small chambers are appropriated to widows or widowers, at sixty pounds per annum; while others are received for forty pounds. In Paris there are also two *Maisons de Santé*, where persons of too limited means to remain in lodgings during their illness, and yet not willing to resort to a common hospital, are received. The number accommodated is 200. A daily sum is required from all; namely, for a bed in the public room, two shillings per diem, and for a private room four shillings or five shillings per day. This includes diet, medical attendance, and other expenses.

In the various provincial hospitals of France and Germany, those of the patients who are in a condition to pay a small sum towards their maintenance, do so; at Strasburgh, about sixty out of five hundred thus contribute, and at Lyons a better class of patients are admitted on the same conditions. At Berne, those who can pay a small sum are received into an adjoining building, which also contains a department for lodging mechanics and strangers on their passage through the town, of whom sometimes three hundred have been accommodated on one night. There is another ward reserved for servants who can pay a certain sum.

In the general hospital of Vienna there are also two classes of patients—gratuitous and paying. For a florin a day an individual has a room to himself; and if the accommodation be less the price is much diminished. At Milan and Naples, wards are reserved where the patients pay two francs a day; and at St. Petersburgh the nobles pay a certain sum for each serf while in the hospital. An institution has been established near the Regent's Park, London, upon the plan of the *Maisons de Santé*, at Paris; and judging from the great good these have effected in the latter city, it is probable it will supply a want felt to exist among some respectable, though not wealthy classes of society.

At the French hospitals another arrangement exists, which we could wish to see introduced into our own, namely, the establishment of convalescent wards; or still better, if, as at the general hospital of Vienna, a separate building for the convalescent patients could be erected.

If we find something to admire, and even to imitate, in the foreign establishments, we cannot bestow our approval when speaking of their Foundling Hospitals. Some of these institutions are of immense extent, as those of Paris, Milan, Moscow, and St. Petersburgh; this last containing four or five thousand infants. The two extremes have been tried; for, in ancient times, the barbarous abandonment of children was not punishable, and in modern times all brought to the doors of the

hospitals have been received. It is difficult to say which of these proceedings is the most injurious, although the motives influencing them are widely different. This ready reception of foundlings has produced a lax morality, by encouraging the reckless incurring, and heartless abandonment, of maternal responsibility—to the severing of those ties between mother and child, which the very brute creation teaches us to respect; while, by the congregation of young children which it renders unavoidable, it has become itself a frightful source for the generation of infantile disease and mortality. M. Benoiston de Chateauneuf states (*Annales d'Hygèine*, Vol. XXI.), that between the years 1824 and 1833 there were received into the French foundling hospitals 452,000 infants. During the ten years there died in the hospital 46,000, and at nurse 151,750—in all 198,505. There were 127,000 received in 1837, at an expense, as he calculates, of eleven million francs. Since that period we believe the French government have determined on abolishing this indiscriminate admission.

One important feature connected with hospitals is entirely of modern origin; we mean, the attaching medical schools to them. This is of such vital importance to the community, that even were hospitals worthless on every other ground they should be sustained on this account alone. Yet, let it not be supposed that the interests or comforts of the occupants suffer for the sake of this advantage which society at large derives from these institutions. No one, at all acquainted with hospitals, is ignorant that the superintendence by the medical students insures a much more satisfactory carrying out of the views of the medical officers than would otherwise take place; while these latter, acting in the presence of a body of persons, able and willing to criticize their proceedings, receive the highest stimulus possible to the due discharge of their duty. J. C.

SINCE, of desires, some are natural and necessary; others natural, but not necessary; and others neither natural nor necessary, but the offspring of a wrong judgment; it must be the office of temperance to gratify the first class, as far as nature requires; to restrain the second within the bounds of moderation; and as to the third, resolutely to oppose, and if possible entirely repress them.—*History of Philosophy.*

THE beauty of sunset, in a fine autumnal evening, seems almost incapable of addition from any circumstance. The various and radiant colouring of the clouds, the soft light of the sun, that gives so rich a glow to every object on which it falls, the long but mellow shades with which it is contrasted, and the calm and deep repose that seems to steal over universal nature, form altogether a scene, which serves, perhaps better than any other in the world, to satiate the imagination with delight; yet there is no man who does not know how great an addition this fine scene is capable of receiving from the circumstance of the evening bell. In what, however, does the effect of this most picturesque circumstance consist? Is it not in the additional images which are thus suggested to the imagination? images, indeed, of melancholy and sadness, but which still are pleasing, and which serve most wonderfully to accord with that solemn and pensive state of the mind, which is almost irresistibly produced by this fascinating scene.—ALISON.

THOSE who devote themselves to the peaceful study of nature (observed a philosopher who confirmed his opinion by his example) have but little temptation to launch out upon the tempestuous sea of ambition; they will scarcely be hurried away by the more violent or cruel passions, the ordinary failings of those ardent persons who do not controul their conduct: but, pure as the objects of their researches, they will feel for everything about them the same benevolence which they see nature display towards all her productions.—CUVIER.

CONSTANT pain is a sad grievance, whatever part is affected; but patience is an anodyne of God's own preparation, and of that He gives largely to those who seek it.—COWPER.

GROUND-ICE.

II.

IN a late article we gave some instances in which it has been observed that in several rivers of our own country, ice begins to form at the bottom, instead of at the surface of the water. Evidence of the same fact has been also furnished in the rivers of other countries; and M. Arago has collected this evidence with a view to the explanation of the phenomenon. He remarks, that if the formation of ice in the beds of rivers has only appeared recently as an established fact in scientific works, it is because their authors generally copy from each other, each neglecting what his predecessor neglected; and because academical collections, in which many treasures remained concealed, are very seldom consulted.

It appears that, in many cases, those large bodies of ice which are carried down by rivers towards the sea, and in their passage become arrested by bridges, or other obstacles (thus often causing fatal accidents), are actually formed at the bottom of the stream, though they afterwards become disengaged from it and rise to the surface. Evidence of this has been furnished from so many quarters, that it will be difficult any longer to doubt that this phenomenon, strange though it be, is not of common occurrence.

M. Beaun, a bailiff at Weld Wilhelmsburgh, on the Elbe, published in 1788, many dissertations, in which the existence of ice on the bottom of a river is established, either by his own observations or by the unanimous declarations of fishermen, procured after a most careful investigation. The fishermen asserted that during the cold days in autumn, long before the appearance of ice on the surface of the river, the nets which were at the bottom of the water were covered with such a quantity of *grund-eis* that they drew them up with great difficulty; also, that the baskets which are used for catching eels, on being brought up to the surface, were often encrusted with ice; that anchors which had been lost during the summer, again appeared in the following winter, being raised up by the ascensive force of the ice at the bottom which had covered them; that this ice raised up the large stones to which the buoys were attached by chains, and occasioned the greatest inconvenience by displacing these useful signals.

These various observations were confirmed by Beaun on his own authority. He discovered experimentally, that hemp, wool, hair, moss in particular, and the bark of trees, are bodies which on being placed at the bottom of water, are very speedily covered with ice. He states that various metals do not possess this property in the same degree; that tin occupies the first rank,—iron the last.

Some interesting observations on the ground-ice of the Siberian rivers were made by Mr. Weitz, superior officer of the Imperial Russian Mining Corps, and communicated to the Royal Geographical Society. We find them in the sixth volume of their *Journal*. It appears that in traversing the rapid rivers of the north at the beginning of winter, this gentleman was led particularly to notice the formation of ground-ice. These rivers flow with great rapidity over a sandy or stony bed, and notwithstanding the duration and intensity of the cold, and the abundance of snow, they continue to flow, bearing along vast quantities of floating ice brought from their source, and augmented by what is detached from the sides, as also by what rises from the bottom. The Kann is a river of this kind; it takes its rise in a branch of the Siansk mountains, and empties itself into the Jeneseï, forty versts from Kranojarsk. Mr. Weitz traversed this river in November, after much hard frost, and had an opportunity of observing the formation of ice at the bottom. The ice was in long prismatic and pyramidal crystals, collected some-

times into large masses, reposing on the bottom. The great transparency of these rivers made the ice at the depth of fourteen feet quite evident. It had a greenish tinge, and looked not unlike moss. Sometimes it became detached from the bottom, and on rising to the surface it soon grew more compact by contact with the cold air, and floated away with the other flakes. It frequently happens that these pieces, in rising from the bottom, bring up with them sand and stones, which are thus transported by the current. Arrived at those parts of the river where, from the very little slope of the bed, the motion of the water is slow, and where the surface is sometimes frozen over, these floating masses collect, rub against each other, and get fixed; whence the inhabitants affirm that the river first freezes towards the lower part of the stream, and that from thence the congelation proceeds upwards till it reaches the higher and most rapid parts. Others assert that, where the water is shallow the ice begins to form at the bottom, and increases upwards by degrees till it gains the surface; thus forming a barrier to the ice-meers that come down, and contributing by this means to the congelation of the surface of the whole river. When the thaw sets in, the ice becoming rotten, lets fall the gravel and stones in places far distant from those whence they came.

A striking example of the formation of ground-ice is mentioned by the Commander Steenk, of Pillau. On the 9th of February, 1806, during a strong south-east wind, and a temperature a little exceeding 34° Fahr., a long iron chain, to which the buoys of the fair-way are fastened, and which had been lost sight of at Schappelswrack in a depth of from fifteen to eighteen feet, suddenly made its appearance at the surface of the water, and swam there; it was, however, completely encrusted with ice to the thickness of several feet. Stones, also, of from three to six pounds' weight, rose to the surface; they were surrounded with a thick coat of ice. A cable, also, three and a half inches thick, and about thirty fathoms long, which had been lost the preceding summer in a depth of thirty feet, again made its appearance by swimming to the surface; but it was enveloped in ice to the thickness of two feet. On the same day it was necessary to *warp* the ship into harbour in face of an east wind; the anchor used for the purpose, after it had rested an hour at the bottom, became so encrusted with ice, that it required not more than half of the usual power to heave it up.

On the 11th of February, 1816, the engineers of bridges and roads, residing at Strasburg, saw above the bridge of Kehl, that many parts of the bed of the Rhine were covered with ice. About ten o'clock, A.M. this ice became loose, rose to the surface, and floated. The thermometer in the open air stood at 10° Fahr.; the water in the river at every depth was at 32°. The ice at the bottom was only formed in places, however, where there were stones and angular projections. It was spongy, and formed of ice spicula. The overseers of the bridge stated that it never appeared on the surface until after ten or eleven o'clock in the morning.

During the winter of 1823, Professor Merian carefully examined the bed of the canal of St. Alban, which conveys the waters of the Birse through the town of Bale. The stream is very limpid and flows rapidly. The bed is generally covered with pebbles. The Professor noticed that wherever the bottom exhibited any projections, there was a small piece of ice, which might have been supposed at a distance to be a re-uniting of tufts of cotton. This ice became disengaged from the bottom from time to time, and floated on the surface. It had all the appearance of the grund-eis of the German watermen.

M. Hugi, president of the Society of Natural History at Soleure, observed in February, 1827, a multitude of large icy tables on the river Aar. These were continually rising from the bottom, over a surface of four hundred and fifty square feet, and the phenomenon lasted for a couple of hours. Two years afterwards he witnessed a similar occurrence. On the 12th of February, 1829, at sun-rise, and after a sudden fall in the temperature, the river began to exhibit numerous pieces of floating ice, although there was no sign of freezing on the surface, either along the banks, or in shady places where the water was calm. Therefore it could not be said that the floating masses were detached from the banks. Nor could they have proceeded from any large sheet of ice farther up the river, because, higher up, the river exhibited hardly any ice. Besides, flakes of ice commenced soon to rise up above the bridge; towards mid-day, islands of ice were seen forming in the centre of the river; and by the next day these were twenty-three in number; the largest being upwards of two hundred feet in diameter. They were surrounded with open water, resisting a current which flowed at the rate of nearly two hundred feet in a minute, and extended over a space of one-eighth of a league. M. Hugi visited them in a small boat. He landed, examined them in every direction, and discovered that there was a layer of compact ice on their surface a few inches in thickness, resting on a mass having the shape of an inverted cone, of a vertical height of twelve or thirteen feet, and fixed to the bed of the river. These cones consisted of half-melted ice, gelatinous, and much like the spawn of a frog. It was softer at the bottom than at the top, and was easily pierced in all directions with poles. Exposed to the open air, the substance of the cones became quickly granulated, like the ice that is formed at the bottom of rivers.

In the same year the pebbles in a creek of shallow water near a very rapid current of the Rhine, were observed to be covered with a sort of transparent mass, an inch or two in thickness, and which, on examination, was found to consist of icy spicula, crossing each other in every direction. Large masses of spongy ice were also seen in the bed of the stream, at a depth of between six or seven feet. The watermen's poles entered these with ease, and often bore them to the surface. This kind of ice forms most quickly in rivers whose bed is impeded with stones and other foreign bodies.

It is unnecessary to give further instances of the recurrence of ground-ice; but it is time that we inquire concerning the cause of its formation. It may first be desirable to have a clear idea of the process of freezing, under the ordinary circumstances, and where the surface of still water becomes ice.

Every one knows that if liquids of different densities be poured into a vessel, the heavy will sink to the bottom, and the light will remain at the top. This applies equally to different kinds of liquids, and also to one and the same liquid under varying temperatures. Liquids, like all other bodies, become more dense as their temperature diminishes. But there is a certain point in the temperature of water which presents a very singular exception to this rule. If water is taken at 50° Fahr. and gradually cooled, it becomes successively denser and heavier, until it reaches a temperature of about 39½°, when it attains its greatest amount of contraction by cold. After this point it is a very curious fact that any further increase of cold causes it to expand, and consequently to become lighter, until it attains the freezing point, *i. e.*, 32°, when a further and sudden expansion takes place, and it becomes ice. Were it not for this beautiful provision in the case of water, our lakes and rivers, instead of freezing gradually, would become almost in a moment a solid mass of ice, from which it is evident that the most serious evils would result. But under the law which thus providentially regulates the congelation of water, the freezing of a lake or pond, or other body of still water, proceeds as follows. The first effect of the diminishing temperature of the air is to

cool the particles of water on the surface, and thus make them denser and heavier than the particles below. It naturally follows that the upper particles sink, and the lower rise to take their place. These in their turn become cooler and heavier, and sink likewise, being replaced by others. This successive cooling of the different layers of water goes on until the whole mass has attained the point spoken of above, *i. e.*, about 39½°, when it is at its greatest condensation. The continuance of the cold after this point, therefore, does not, as before, make the upper layer of water heavier, and cause it to sink, but on the contrary it makes it lighter, and thus *keeps* it at the surface. The expansion and consequent lightness of this upper portion of the water thus increases as the cold becomes greater, until it reaches the temperature of 32°, or freezing-point, when under ordinary circumstances, a layer of ice is formed. This coat of ice is in some measure a barrier to the effect of the atmosphere on the water beneath, so as to make it remain longer in a liquid state. But if the condensation of water went on regularly increasing up to freezing-point, the continual sinking of the colder portions would so affect the whole mass, that the whole would become, as we have already observed, a solid mass of ice. Surely there is ground for admiration and thankfulness in this exception to the rule by which all other liquids are governed; an exception which bears the stamp of beneficence, and affects in a very high degree the well-being of men and animals.

Such is the process of freezing as regards still water; let us now consider the modifications which the motion of the water is likely to produce.

The effect of this motion when it is rather rapid, when it forms eddies and flows over a rocky or unequal channel, is perpetually to mix all the layers. The law which regulates the congelation of still water, no longer applies. The water which is lightest does not always float on the surface. The currents are precipitated into the general mass, which is thereby cooled, and the temperature therefore soon becomes equal throughout.

In a deep mass of still water the temperature of the lowest part can never descend below 39°; but when this mass is in a state of agitation, the surface, the middle, and the bottom, may be found at the freezing-point, or 32°, simultaneously. It becomes therefore necessary to inquire, why when this uniformity of temperature exists, and when the entire mass of liquid is at the freezing-point, congelation commences at the bottom, and not at the surface.

In the first place, crystals are known to form more easily on unequal or pointed surfaces, than on any other, and therefore when the whole body of water has arrived at the freezing-point, it is not to be wondered at that the crystals begin first to form on the stones or other projections at the bottom of a river. Again, it is to be recollected that the motion of the waters has much to do in modifying the effect. At the surface this motion is very rapid and irregular in all those rivers in which ground-ice has been formed; while at the bottom of the river the motion is at least considerably diminished, so that although it may be sufficient to prevent the formation of compact ice, such as we see at the surface of still water, yet it may not prevent the gradual accumulation of that spongy kind of ice described in some of the foregoing examples, which could be easily pierced by the watermen's poles.

This appears to afford the true solution of the difficulty respecting ground-ice; but there have been other theories on the subject which must not be withheld. That of Mr. Eisdale was founded on information which he had received from country people and others, whose operations depended on water-wheels, and whose interests forced them to attend to appearances, which might pass unheeded by others. The sum of their information was that the ground-ice was never formed except after a heavy *rime*, or hoar-frost. Hence Mr. Eisdale is disposed to offer the following explanation. The hoar-frost, which is congealed moisture precipitated from the atmosphere, and falling into the river when the water is cooled down to the freezing-point, cannot be dissolved. It retains in the water the very shape in which it descends from the air. When these small crystals fall on a deep unfrozen pool, the water being above the freezing-point, the particles melt and are incorporated with the water; but in a shallow and agitated stream, almost the whole water is brought in succession into contract with the intense frost, and may thus be cooled down to the freezing-point to the very bottom of the stream, before even a pellicle of ice is formed on the stagnant pool. All the particles of hoar-frost, then, or frozen vapour, which fall on such a stream, will remain unmelted; and being tossed in all directions by the agitations of the current, will be brought into contact with the rocks or other substances projecting from the bottom, to which they will readily adhere, and form a *nucleus* for the *ground-ice*.

Mr. Weitz conceives that the intensity and long continuance of the cold may freeze the soil to the depth of the bottom of the river, particularly where it is not deep, and that there the diminished velocity of the water permits of its congelation, particularly if there be any hollows where the water remains stagnant. So long as the congealed masses continue small with regard to the volume of water immediately above them, they adhere as if rooted to the bottom, and they rise bringing with them such gravel and stones as are found attached to them; whence Mr. Weitz concludes that not only does the current occasion a change in the bed of the river, by its erosion of the looser soil which it carries from one place to another, but that the ice which forms at the bottom of rapid rivers, in very cold countries, tends also to affect a change in the beds of those rivers.

Mr. Farquharson has also a theory which is founded on the principle of the radiation of heat. Those parts of the bed of the stream which radiate most freely, become cooled most rapidly to freezing temperature, and hence ice is deposited in a manner somewhat similar to the deposition of dew, viz., the earth by radiation becoming colder than the atmosphere, condenses the vapour into drops of water; and so by the free radiation of some portions of the bed of the stream the water may become converted into particles of ice.

In concluding our notice of this interesting subject, we may remark that although the theory of the formation of ground-ice is yet involved in much obscurity, the reader will be repaid the trouble of perusing the large number of facts which we have thus brought together from various sources; and should he be able to contribute any observations of his own they will be valuable, and still more so if given entirely free from theory.

IN their great designs men show themselves as they would wish to be; in small affairs they appear in their real characters.

THE fruits of toil are the sweetest pleasures.

WE should learn to think on principles in an age which cares only to remember facts.

IT is cheaper to educate two children than to feed a single vice.

THE tricks of involuntary actions, as twitchings of the face, restless gesticulations of the limbs, biting the nails, &c., are generally at first occasioned by the want of sufficient bodily exercise to expend the superfluous animal power, but are also acquired by imitation. Hence long continued quiet, so often imposed in schools, should be avoided.—*Encyclopædia.*

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